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PATENT SPECIFICATION

(11) 1 345 305

(21) Application No. 18181/72 (22) Filed 19 April 1972

(31) Convention Application No. 5 288 (32) Filed 23 April 1971 in

(33) Sweden (SW)

(44) Complete Specification published 30 Jan. 1974

(51) International Classification F02B 37/02

(52) Index at acceptance
F1B 2L4D 2N13 2N14A 2N16A

(54) A SUPERCHARGED TWO STROKE INTERNAL COMBUSTION ENGINE

(71) We, AKTIEBOLAGET GOTAVERKEN, a Swedish Body Corporate, of 9 Stjarngatan, 402 70 Goteborg 8, Sweden, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a two stroke internal combustion engine, where the combustion air during normal running is supplied by an exhaust gas turbine driven compressor plant.

The demand for the higher specific output has brought about an increase of the pressure of the air supplied to the engine to a value exceeding that of the atmospheric pressure by more than 100%, which imposes certain demands upon the compressor plant. A single-stage centrifugal compressor will not operate with a high efficiency if the ratio between the pressures at the outlet and at the inlet, respectively, exceeds 2:1, and it therefore has been found expedient to arrange the compression of the air into two steps, whereby the further advantage is obtained that a cooler may be fitted between the two compressors. This will on the other hand impose certain demands upon the turbine part of the plant, where it on the one hand is desirable to be able to use units of standardised sizes, and on the other hand to arrange the turbines in such a manner that the mean efficiency of the plant will be high.

The present invention provides a two stroke internal combustion engine supplied with supercharging air at a pressure of at least 1 bar gauge from an exhaust gas turbine driven compressor plant characterised in that the compressor plant includes at least one group of two compressors connected in series with an interposed cooler the capacity of which is sufficient to permit the air to enter the second compressor of the series at substantially the same temperature as that of the ambient air being drawn into the first compressor, and that each compressor is driven by an exhaust gas turbine said turbines being arranged in series, with a first turbine connected to receive exhaust gas from an exhaust gas receiver connected to receive exhaust gas from the engine and having a volume such that the gas suppled to said first turbine during normal running will absorb fluctuations in the pressure, and that the outlet from the first turbine is directly connected to supply exhaust gas to the inlet of the second turbine without any receiver being interposed, the arrangement being such that the power consumption in the two compressor turbine units is substantially equal.

One embodiment of the invention as utilized with a six-cylinder two stroke internal combustion engine will now be described by way of example with reference to the accompanying schematic drawing in which there is shown an engine provided with six cylinders 10, which are connected to an air manifold 11 and an exhaust gas receiver 12. The latter has a sufficiently large volume to absorb the exhaust pulses from the individual cylinders. The engine is supplied with supercharging air at a pressure of at least one bar gauge.

Two similar turbines 13 and 14 are connected to the exhaust gas receiver 12 in such a manner that a first turbine 13 by way of a conduit 19 is connected to the exhaust gas receiver 12, whereas the outlet from this turbine by way of a conduit 20 is directly connected to the second turbine 14. This drives a first compressor 15, and turbine 13 drives a second compressor 16. A first cooler 17 is fitted between these compressors and downstream of com-

[*Price 25p*]

pressor 16 a second cooler 18 is fitted. The air in the engine room may have a temperature of about 20°C. (and incidentally downstream of the first compressor a temperature of about 90°C.). Cooler 17 has such a capacity that the air before entering the second compressor 16 will be cooled down substantially to the same temperature as that of the ambient air. The increase in temperature in the second compressor is about the same as in the first compressor, but the temperature of the air supplied to manifold 11 will not have to be cooled as much as between the compressors, say to 45°C., which means that cooler 18 may be somewhat smaller than cooler 17.

In order to maintain favourable operating conditions and a rational utilisation of the energy content of the exhaust gases the plant is arranged in such a manner that the power consumption is substantially equal at each compressor. As the second compressor 16 will handle air which is already compressed, and because it is possible by means of the intermediate cooler to reduce the air volume further, compressor 16 will be somewhat smaller than compressor 15. The turbine 13 may be selected to be somewhat smaller than turbine 14, i.e. it has a size which with respect to space requirements will better fit together with compressor 16. It is however necessary to observe that the area of the turbine inlet members will have to be selected in a manner to provide the necessary power.

With engines having a large number of cylinders it is of course possible to arrange several groups corresponding to the one shown, each group consisting of two compressors and two turbines connected to a common exhaust gas receiver. In this manner it is possible to keep the individual turbine and compressor units at a reasonable size, even with a very large engine plant.

By having the turbine working according to the constant pressure principle it is possible to obtain a high efficiency, and the turbines may be mounted in any suitable place with respect to the engine, which is not possible with turbines working according to the pulse principle. This will noticeably simplify the arrangement within the engine room.

WHAT WE CLAIM IS:—

1. A two stroke internal combustion engine supplied with supercharging air at a pressure of at least 1 bar gauge from an exhaust gas turbine driven compressor plant characterised in that the compressor plant includes at least one group of two compressors connected in series with an interposed cooler the capacity of which is sufficient to permit the air to enter the second compressor of the series at substantially the same temperature as that of the ambient air being drawn in to the first compressor, and that each compressor is driven by an exhaust gas turbine said turbines being arranged in series, with a first turbine connected to receive exhaust gas from an exhaust gas receiver connected to receive exhaust gas from the engine and having a volume such that the gas supplied to said first turbine during normal running will absorb fluctuations in the pressure, and that the outlet from the first turbine is directly connected to supply exhaust gas to the inlet of the second turbine without any receiver being interposed, the arrangement being such that the power consumption in the two compressor turbine units is substantially equal.

2. A two stroke internal combustion engine substantially as hereinbefore described with reference to and as shown in the accompanying drawing.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1974.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

1345305 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*